Journal of Physiotherapy & Physical Rehabilitation

Ganvir and Harishchandre, Physiother Rehabil
2017, 2:1
DOI: 10.4172/2573-0312.1000131

Research Articel OMICS International

Is Scoring on Berg Balance Scale Affected By Items Being Performed By Sound Side or An Affected Side?

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Received date: February 17, 2016; **Accepted date:** March 16, 2017; **Published date:** March 23, 2017

Abstract

Introduction: Berg Balance Scale is a commonly used outcome measure in patients with stroke. But certain items in the scale when performed on affected or unaffected side may score differently.

Procedure: It was an observational study on 50 patients with stroke. Berg Balance scale was administered on these patients. 6 items in the scale were performed first with affected side BBS-A and then with unaffected side BBS-NA. Rest was performed with routine procedure.

Results: Item wise and cumulative means were calculated and ICC was computed for each. Cumulative score was statistically significantly different between BBS A and BBS NA (ICC=0.23). Item wise also there were significant differences between the scores.

Conclusion: Results of the study indicates that there is a difference in the scores obtained when some items are performed with affected or non-affected extremity.

Keywords: Berg Balance scale; Stroke; Score

Introduction

Balance impairment is the most common impairment of hemiparesis due to stroke. To measure balance particularly in patients with stroke various scales have proved their validity and reliability. One such scale commonly used in these patients is Berg Balance Scale. Originally devised for elderly subjects it very commonly used in various studies on patients with stroke as an outcome measure for measuring the effectiveness of intervention or in observational studies [1-3].

Hui-Fen et al. studied the psychometric properties of three clinical balance measures and found that the BBS, FM-B, and PASS all had good reliability and validity for patients at different recovery stages after stroke [1]. De-Oliveira et al. has summarised the various balance assessment scales and has said that the BBS has Internal consistency: Cronbach (α)=0.92-0.98; Interrater reliability: ICC=0.95-0.98; Intrarater reliability: ICC=0.97; Test-retest reliability: ICC=0.98; Validity (r): Barthel Index=0.8-0.94; Balance subscale of Fugl-Meyer test=0.62-0.94 [2]. Chun-Hou Wang et al. modified the 5 level BBS to 3 levels and found that the BBS-3P and PASS-3P showed high concurrent validity with the BBS and PASS, good predictive validity for disability, and moderate to high responsiveness. Importantly, the psychometric properties of the BBS-3P and PASS-3P were essentially identical to those of the original BBS and PASS [3-5].

If the items of BBS are considered individually, scoring on the items such as reaching forward with outstretched arm, retrieving object from the floor, turning to look behind, turning 3600, placing alternate foot on a stool, placing one foot infront of the other, and most importantly standing one one leg, will be different if they are performed with sound or affected extremity. Sarah has also studied various balance measurement scales in patients with stroke and found that BBS has strong psychometric properties making it a useful test for patients with stroke [4,6,7].

But none of these or other studies mentions that whether it was sound side or the affected side that was used or used first or last for the items 8th onwards. As the BBS is originally developed for elderly subjects, it also does not mention these points [5,8,9].

Considering the possible effect of whether these items are performed with sound side or on the affected side on individual scoring, total scoring and also on its interpretation, it was thought to conduct this study. Our hypothesis was that if most of the items in BBS are performed with the affected side then the scoring would be much less as compared to if is performed with the sound side.

Methodology

It was an observational study. Ethical committee clearance was obtained from the institutional Ethical committee. The study was conducted from January 2012 to September 2012. Patients diagnosed as first ever unilateral stroke with maximum duration of 1 year were included in the study. Patients with a diagnosis of cerebral infarction or cerebral hemorrhage were included in the study. Patients with any other associated systemic disease which might have an effect on balance were excluded.

A group of 50 such patients were assessed with BBS on one occasion in two sessions. In the first session, the affected side was used for items 8th onwards and this data was named BBS-A. With enough rest periods, BBS was again administered but now with non-affected side

and this data was named BBS-NA. Patients were assessed for Barthel Index (BI) which was used as an external criterion for the examination of convergent validity.

Performance or instructions for first 7 items did not vary between the two sessions. For 8th item subject was first asked to reach forward with sound side upper extremity, irrespective of the handedness. Then in the next session the subject was asked to reach out with affected side, irrespective of the strength or available voluntary control. For the 9th item, again subject was asked to pick up the object with sound upper extremity first and then in the next session, he was asked to pick up the object with affected side. For 10th item, initially the subject was asked to first look behind from sound side and then he was asked to look from affected side. The process was repeated in the next session but with reverse order i.e. subject was asked to look behind from affected side first and then from the unaffected side. 11th item dealt with ability of the subject to turn 360° first from sound side and then affected side. In the second session, subject was first asked to rotate from affected side and then from sound side. In the 12th item, subject was asked to first keep the sound leg on the step and then the affected leg. In the next session the process was reversed. In 13th item, subject was asked to keep his sound leg in front of the other leg. In the next session, the affected leg was placed in front of the sound leg. For the 14th item, subject was first asked to stand on sound leg and scoring was done. In the next session, the subject was asked to stand on the affected side, score was noted. Thus the two sets of data were collected.

Results

Total of 54 patients were recruited for the study. 4 patients dropped out of the study as they could not complete the procedure on two occasions.

Parameters	BBS
Sex-male/female	29/21
Age	
X	58.9
SD	10.9
Range	37-67
Diagnosis	
Cerebral Haemorrhage	26
Cerebral infarction	24
Side of hemiplegic-rigth/left	27/23
BBS-A	
Median	23.9
Interquartile range	19-26
BBS-NA	
Median	30.9
Interquartile range	25-35

Table 1: Characteristics of the Subjects with Stroke Who Participated in the Study (n=50).

Table 1 shows the demographic features of the study participants. The fixed effect of ICC Model 3 was used to compute the ICC value for the degree of agreement between repeated measurements. An ICC value of >0.80 indicates high reliability.

Concurrent validity

Wilcoxon matched-pairs signed-rank tests were performed to determine the statistical significance of the differences between scores. In addition, the Spearman ρ was used to examine the interrelationships between data obtained with the affected side BBS-A and data obtained with the non-affected side BBS-NA. The value was found to be 0.78 which is not statistically significant.

Convergent validity

Convergent validity was determined by examining the relationships between data obtained with the measures and data obtained with instruments measuring similar constructs. The relationships between the total scores of the BBS-A and BBS-NA and the BI were examined using the Spearman ρ. The value was found to be 0.76 for BBS-A and 0.73 for BBS-NA. Further the extent of agreement between the two scores was measured with the help of Intra class Correlation Coefficient (ICC) (Table 2).

Item	BBS-A	BBS-NA	ICC
Sitting to standing	4	4	0.99
Standing unsupported	4	4	0.98
Sitting unsupported	4	4	0.99
Standing to sitting	3	4	0.97
Transfers	2	4	0.09
Standing with eyes closed	3	3	0.99
Standing with feet together	3	3	0.99
Reaching forward with outstretched arm	1	3	0. 09
Retrieving object from the floor	1	3	0.07
Turning to look behind	2	3	0.09
Turning 360°	2	3	0.09
Placing alternate foot on stool	2	3	0.08
Standing with one foot in front	2	4	0.05
Standing on one foot	1	3	0.04
Mean score	24.5	32.6	0.23

Table 2: Item wise and cumulative means of BBS-A and BBS-NA along with level of significance along with value of ICC for each item and cumulative means.

Discussion

Many studies have used BBS to detect changes in balance impairment over a time in patients with stroke [7,10-12]. Psychometric properties f BBS have been studied in details [8,13-15]. This important property of the scale would be affected if two different examiners

perform the test on two different occasions not aware of the side of the patient that was used every time. This will happen because the instructions are not clear for the stroke patients. But there is a great difference in the scores of BBS when the subject was asked to perform some items with affected side and non0affected side.

If we consider first 4, 6 and 7th items, side of affection does not have much influence on the scoring. For 5th item, the transfer from the affected side will definitely be delayed as compared to non-affected side. So the time, the comfort with which the patient will perform the task in both instances would be different and hence would be graded differently. 8th item namely, reaching forward on the outstretched arm, can be performed by hemiparetic or a normal side. In both cases the scoring would be different. The maximum scoring depends on the strength or voluntary control of the upper limb when performed by the affected side.

A researcher may ask the subject to perform with unaffected side and the scoring would be entirely different. Scoring of 9th item, retrieving object from the floor, also will be affected whether it is performed by affected or unaffected side. In some cases patients may not be able to manipulate or hold an object with affected side at all. Whereas at the other end the task is performed by the sound side scoring would be maximum. For 10th item patient will definitely take more time if he is instructed to look behind from his affected side as he will need to bear more weight on his affected side. Whereas the patient dose same movement from his non-affected side, he would definitely take less time. Though it is the total time taken for both movements is taken into consideration, it may be possible that the patient is entirely not able to look behind on the affected side.

This option has not been graded at all. Standing unsupported with one foot in front does not indicate if the affected or unaffected foot needs to be kept forward. For patients with stroke keeping the affected extremity in front of the sound extremity would be much more difficult. In our study we found that 40% of the subjects were not at all able to do it. Whereas they were comfortable with placing the sound leg in front. This resulted in great variation of the scoring in same subject. Standing on one leg is similarly a tricky item wherein the scores would be entirely different if the subject stands on a sound leg and on affected leg.

Studies have used BBS to predict the fall in patients with stroke and found it to be a good predictor of fall [8,16,17]. Also BBS is used to differentiate between fallers and non-fallers [18-21]. But difference of score in our study has resulted in statistically significant variation in the total score, based on which the subject is categorized into faller or a non-faller cut off value for which is given to be <29.

Thus it may be possible that a patient who actually would score less than 29 may get greater score if he or she performs these items with sound side. So he or she may have a poor balance but can be graded as a non-faller.

So the same subject based on scoring by BBS-A and BBS-NA may fall into the two different criteria. But there is no study till date concerned with this delicate issue in patients with stroke.

Conclusions

Results of the study indicate that there is a difference in the scores obtained when some items are performed with affected or non-affected extremity. Considering the potential effect of the side of hemiparesis on individual item scoring, BBS, this very commonly used scale does not give the uniform results and hence needs to be modified.

It is suggested that certain items needs clear instructions in patients with stroke. This study is continued further in the form of modifying the BBS in accordance with the requirement of patients with stroke and establishing its reliability and validity in patients with stroke.

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